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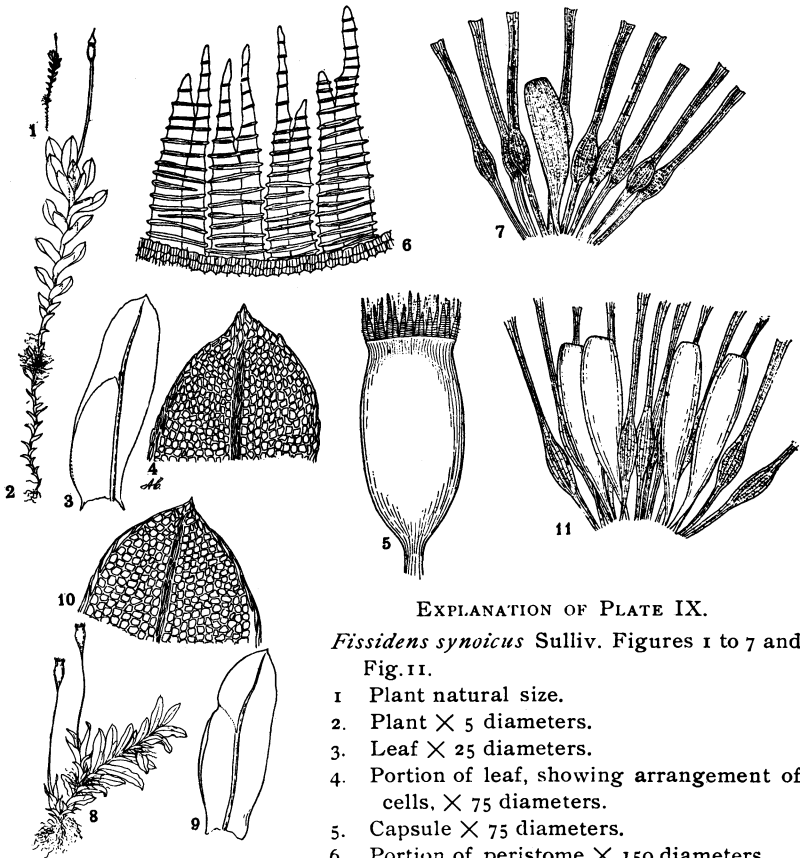
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EXPLANATION OF PLATE IX.

Fissidens synoicus Sulliv. Figures 1 to 7 and Fig. 11.

1. Plant natural size.
2. Plant $\times 5$ diameters.
3. Leaf $\times 25$ diameters.
4. Portion of leaf, showing arrangement of cells, $\times 75$ diameters.
5. Capsule $\times 75$ diameters.
6. Portion of peristome $\times 150$ diameters,
7. Synoicus flower $\times 150$ diameters.

11. Flower of *Fissidens synoicus* $\times 150$ diameters.

Fissidens inconstans Schimp Figures 8 to 10.

8. Plant $\times 5$ diameters.
9. Leaf $\times 25$ diameters.
10. Portion of leaf $\times 75$ diameters.

All reduced one-half.

THE VALIDITY OF SOME SPECIES OF FISSIDENS.

E. J. HILL.

Among the species of *Fissidens* which I have observed in the prosecution of field work none have had so varied a treatment as the following: *F. inconstans* Schimp., *F. synoicus* Sulliv., *F. minutulus* Sulliv. and *F.*

exiguus Sulliv. For comparison with these there have been furnished from the Herbarium of Columbia College, New York City, *F. inconstans* Schimp. Cheyenne Cañon, Colorado, 1872; *F. Bambergeri* Schimp., collected by Milde at the original station, Meran, Tirol; *F. bryoides* Hedw. Erb. Critt. Ital.; *F. bryoides* Hedw. from near Durlach, Baden; *F. bryoides* var. *intermedius* Ruthe=var. *gymnandrus* Buse. (No. 1160 of Rabenhorst, Bry. Eur., collected by R. Ruthe, locality not given. This No. 1160 Warnstorf in Kryp. Fl. Mark Brand. Laubmoose 2: 171, 1906, gives as *F. impar* Mitt.). From the Sullivant Herbarium at Cambridge, Mass., *F. synoicus* Sulliv. San Marcos, Texas, Ch. Wright, 1847. From the Field Columbian Museum, Chicago, *F. bryoides* Hedw. Collected by Gmelin, Stuttgart, No. 84879; *F. bryoides* Hedw. Jura franconia, P. Reinsch, No. 84987; *F. incurvus* Schwaegr. Vogesengebiet am feuchten Waldenorten, P. Reinsch, Nos. 84986 and 116238; *F. exiguus* Sulliv. Ex. Musci Allegh No. 84199. The other specimens used are of my own collection, the oldest *F. minutulus* Sulliv. Kankakee, Illinois, 1872, determined for me by the late Thomas P. James. This has been the species most frequently found since, and occurs in examples from Minnesota, Illinois and New York. All my other examples, *F. exiguus*, *F. inconstans*, *F. synoicus*, *F. incurvus* Stark, 1807 (=F. incurvus Schwaegr. 1816), are from northern Illinois.

F. inconstans in the Manual of Lesquereux and James seems to be limited to the collection of Wright at San Marcos, Texas. It is the only example cited, and *F. synoicus* Sulliv. is made a synonym. No reference is made to its presence elsewhere as is usual in the case of rare species. The Colorado specimens were collected by T. C. Porter, July 11, 1872. They are labeled "*F. inconstans* Schimp., Ed. 11 (*F. bryoides* var. *inconstans* Limpr. Laubmoose)." Why it was not referred to in the Manual published in 1884* is not evident. It may have been due to the uncertainty of its standing in the opinion of one of the authors, Mr. James, or have been overlooked. The following note of his (fide Mrs. Britton) accompanies the specimens: "*F. Porteri* n. sp. provisional. Stems branched, the branch bearing the fruit-stalk is attached to the main stem about one-fourth its length. The capsule small, oval, almost rotund. The male organs are axillary on the main stem (Monoecious). Can it be a hybrid between *F. incurvus* and *F. bryoides*?"*
A *Fissidens* which I cannot specifically separate from this I have twice found at a single station at Glenwood, Ill.

Fissidens inconstans was described by Schimper in 1876 from specimens found by H. Boswell near Oxford, England, in 1863 (Synop. Mus. Europ. Ed. 11, 114, 1876.). Its fruit is said to mature in March. Schimper states that it is very inconstant in the position of its fruit, which is sometimes terminal, sometimes lateral and axillary, the capsule smaller than in *F. incurvus*, "always suberect or erect." "Whether a species near to the very polymorphic *F. incurvus* is really distinct or not is doubtful," he adds. Warnstorf, one of the latest authorities, gives it specific rank, grouping it in his Ueber-

*In the Synopsis of the Flora of Colorado, by Thomas C. Porter and John M. Coulter, Washington, D. C., 1874, to which the article on Musci was contributed by Leo Lesquereux, no species of *Fissidens* is given. The list includes, among new ones described, those collected by Porter and others in 1872 and 1873.

sicht der Arten with *F. bryoides* (L.) Hedw. and *F. gymnandrus* Buse, of which he makes a species also. It is marked by an asterisk as not yet found but likely to occur within the area his work embraces, and consequently is not fully described. (Kryp. Flora der Mark Brand. Laubmoose 2: 166, 1906.) This rank I take to be given it also by the way it is labeled in the Herbarium of Columbia College. Roth makes it a variety of *F. bryoides*, as also Limpricht: Husnot a variety of *F. incurvus*; Boulay one of cycle of forms, including *incurvus*, *crassipes*, *pusillus* and *Bambergeri*, all closely allied to *F. incurvus*. Dixon considers it a form or sport of *F. bryoides*; Barnes both this and *F. synoicus* sports of *F. incurvus*. (A Revision of North American Species of Fissidens, Bot. Gaz. 12: 31, 1887.) Here are three main conclusions, (a) a species, (b) a variety, form or sport of *F. bryoides*, (c) a variety or sport of *F. incurvus*.

Since I did not obtain specimens of *F. inconstans* from any European locality, the statements in this paper so far as based on examination of plants refer to the collections from Colorado and Glenwood. There is the possibility that they may not be the equivalents of the European moss, though this seems probable. From the provisional name proposed by James he had his doubts. The plants at Glenwood were first collected October 24, 1899. Having found the synoicous plants in a packet of *Gymnostomum calcareum* obtained at Lockport, Ill., June 29, 1905, but examined some months later, I again visited the Glenwood station April 12, 1906, and fortunately found mature plants, since the first collections were all immature. They were in full fruit, the opercula mostly gone, the capsules frequently injured or broken off from rough usage in the winter. They showed a moss fruiting in the cold season of the year, quite in contrast with the synoicous form from Lockport, not so far advanced the last of June. They were associated with *F. cristatus*, *Dicranella heteromalla*, *Mnium cuspidatum* and a species of *Anomodon*. A full description of the Glenwood and the Colorado specimen is given below, illustrated by a drawing of plant, leaf, and its terminal portion from the Glenwood specimens, Plate IX. Figs. 8-10.

FISSIDENS INCONSTANS Schimp. Plants caespitose or gregarious, bright green. Stems 2-10 mm, high (mostly 3-6 mm.), declined at base or ascending, with copious rhizoids, some as long as the stems. Leaves 6-20 pairs, lingulate to oblong-lanceolate, acute to obtusish and apiculate, $0.9-1.6 \times 0.2-0.4$ mm. with a paler cord-like margin 2-4 cells wide extending to the point or ceasing just below, sometimes wanting on the lower part of the dorsal lamella, frequently loosened and detached part way. Vaginant lamina extending to the middle of the leaf-complex or a little beyond. Costa percurrent. Cells irregularly quadrate to polygonal, 8-14 μ in diameter, the basal larger, nearly quadrangular, 15-30 μ long. Autocious. Male flowers axillary on the middle or lower part of the stem; antheridia few, 1-2 or more, without paraphyses. Perigonial leaves 2-4, broad oval, abruptly narrowed to a point. Inner perichaetial leaves short, ovate to broad oval, acute or acutish, the outer like the stem leaves. Archegonia 2-8, slender, without paraphyses. Sporophyte terminal on the main stem or on short lateral branches. Seta dark red to pur-

ple, 2-3 mm. long. Capsule erect, greenish, slightly oblong to broad oval or suborbicular, 0.8×0.45 mm. (some 0.35×0.3 mm.), a little narrowed below the orifice when dry. Operculum conic-rostrate, brownish, oblique or curved, sometimes as long as the capsule, $0.3-0.35$ mm. Calyptra long pointed, split on one side to the middle. Teeth long and slender ($0.135-0.215$ mm.), very papillose, yellowish, with darker or brownish yellow base, divided about four-fifths their length, the parts near the middle spirally banded and more or less thickened. Spores pale yellow, globular, $9-18\mu$ in diameter. Annulus indistinct, adhering to base of operculum, the small cells with the vertical diameter greater.

Clayey bank of ravine, Glenwood, Ill., Oct. to April, E. J. Hill. Cheyenne Cañon, Colorado, July, 1872, T. C. Porter.

Fissidens synoicus was published in 1856 in a separate, entitled: "The Musci and Hepaticae of the United States east of the Mississippi River, contributed to the Second Edition of Gray's Manual of Botany by William S. Sullivant."* It includes "Additions and corrections" that were to be made to the Manual, whose pagination for the part containing the Musci and Hepaticae ends with page 702. On page 103 of the separate, which would be page 703 of the Manual, was the following description, to be added to those on page 24 (page 624 of the Manual), following No. 3 of the genus *Fissidens* or *F. exiguus* Sulliv.:

"3 b. *Fissidens synoicus* (n. sp.) — Hermaphrodite; stems simple, inclined, 3"-6" long; leaves 12-14 (pairs ?), oblong-lanceolate, oblique, shortly acuminate, bordered except at the denticulate apex, the blade shorter than the duplicature, the dorsal wing vanishing above the base; costa continuous; capsule terminal, oval-oblong, erect; operculum rather long-rostrate. San Marcos, Texas. *Wright*.—A small species, distinct by its whitish green leaves with a close areolation, regular erect capsule, and hermaphrodite inflorescence."

Prof. W. G. Farlow writes me that the only writing on the specimen in Herb. Sulliv. is that given above where the specimen is cited. As seen by the direction given in the separate it was to be placed between *F. exiguus* and *F. minutulus*, which in the Manual are immediately followed by *F. bryoides*, thus indicating its relative position. I append a fuller description, based on the collection from Lockport, which I identify with those from San Marcos, and on those in the Herb. Sulliv. It is illustrated by Plate IX. Figs. 1-7 and Fig. 11. These are made from the Lockport moss.

FISSIDENS SYNOICUS Sulliv. Cespitose, stems mostly simple, erect or inclined at base, 6-12 mm. high. Leaves pale green, 8-20 pairs (mostly 10-15 pairs), oblong-lanceolate to linear-lanceolate, short acuminate or acute and apiculate, $1.1-1.8 \times 0.3-0.45$ mm., the lower shorter; erose denticulate near the point, somewhat wavy-sinuolate below; costa subpercurrent, occasionally forming the point. Border 1-3 cells wide, or on vaginant lamina four cells, frequently indistinct or absent, especially on one side, usually ceas-

*New York, George P. Putnam & Co. Whether the additions and corrections were inserted in subsequent editions of Gray's Manual is doubtful. My copy with the imprint of Ivison and Phinney, 1858, with the copyright of George P. Putnam & Co., 1857, does not contain them. The citation is always from the separate, a very rare book.

ing below the point and on the very narrow base of the dorsal lamella. Vaginant lamina rather more than half the length of the leaf-complex. Cells of middle and upper part roundish hexagonal to polygonal, $6-11\mu$ in diameter, often quite variable: basal cells rather hyaline, quadrangular, some nearly square, $13-27 \times 6-10\mu$. Synoicous or dioicous, the flowers terminal or sometimes in a bud near the base. Antheridia 1-5 (1-7) large, subclavate, the slender archegonia more numerous, sometimes 18-20, without paraphyses. Seta reddish, 3-4 mm. long. Capsule erect, green, oval-oblong to subcylindrical, 0.5-0.7 mm. long, the mouth purplish. Operculum conic-rostrate, long-beaked, $\frac{1}{2}-\frac{3}{4}$ the length of the capsule, straight or slightly oblique, brownish. Teeth russet-brown, broad, rather short, not deeply divided, smooth or little papillose, the broad cross-bars horizontal. Spores globular, green, pitted, $13-16\mu$ in diameter.

Moist and shaded calcareous rocks. Fraction Run (now Dellwood Park), Lockport, Ill., June, 1905, E. J. Hill; San Marcos, Texas, Charles Wright, 1847. At Lockport it is associated with *Gymnostomum calcareum* Br. Germ. and *Amblystegium varium* (Hedw.) Lindb.

The chief difference between *F. inconstans* and *F. synoicus* is in the inflorescence and the time of maturing the spores, winter or early spring in one, early or midsummer in the other. This would of itself suffice to differentiate them specifically. The teeth of the former are slender and quite long, divided below the middle, the parts very papillose and spirally thickened. In *F. synoicus* the teeth are not deeply divided, smooth or smoothish, the parts not spirally thickened. In *F. inconstans* the thickened leaf-border is generally confluent with the costa at the point and readily separates from the cells of the body of the leaf; in *F. synoicus* the border is less developed or more interrupted, not thickened or cord-like, and usually ceases below the point. Its spores are green and pitted, those of *F. inconstans* are yellow or brownish yellow.

In its inflorescence *F. synoicus* is nearest to *F. Bambergeri*. Schimper described this as dioicous, (Syn. Ed. 11, p. 115). Roth, Boulay, Husnot and Milde give it variously as polygamous, synoicous, dioicous. I have found it both synoicous and dioicous. Of twelve stems examined eight had floral organs, two of them synoicous, two had archegonia only, four antheridia, or with buds having the short leaves of the perigonial form. In synoicous flowers the leaves were the larger, perichaetial form, with 2-5 archegonia, and one or more but few large antheridia, all kinds without paraphyses, or rarely with some. In the case of stems without fruit my experience is similar to that of Milde, who says: "I always found the fruiting plants without male flowers. The plant is also dioicous. The sterile plants bear *either* a single female terminal flower, which consists of 5-12 archegonia without paraphyses, *or* a single terminal hermaphrodite flower in which I found 1-3 antheridia and 3-5 archegonia without paraphyses. Since the antheridia were always very large an error is not possible. The archegonia on the other hand were always very long and slender." (Zur Kryp. Flora sud. Tirol. Bot. Zeit. 22: 12, 1864.) Milde considers it similar to *F. incurvus*; Schimper as

nearest *F. minutulus*, its time of fruiting "early spring." Roth says "late autumn and winter." In this character it is allied to *F. bryoides*, *inconstans* and *incurvus*.

F. Bambergeri is in almost all respects smaller than *F. synoicus*. The stems are 1-3 mm. high, with 4-12 pairs of leaves, those of the middle part of the stem, $0.6-0.8 \times 0.2-0.27$ mm., the cells $4-8\mu$ in diameter. The seta is relatively long, 2.5-5 mm., the pale capsule 0.4-0.6 mm., the yellow-brown spores $12-15\mu$. The teeth are split about $\frac{2}{3}$ their length, slightly papillose, the parts spirally thickened. The leaves are rather obscurely margined, generally by a single row of cells often broken or interrupted, absent from some part or wholly gone. When absent the margin becomes a row of quadrate, nearly square pellucid cells similar to the margin of the leaves of *F. exiguus*. The habitat of *F. Bambergeri* in Tirol is given by Roth as "sandy loam in little hollows of rocks on hot slopes," thus pointing to a xerophytic nature, while *F. synoicus* at Lockport is mesophytic.

F. synoicus should also be compared with *F. incurvus*. The inflorescence of this is autoicous, the antheridia terminal on short branches near the base of the fertile stems. The sharp pointed leaves are not bordered quite to the denticulate apex, the costa ceases just below the point, or becomes protuberant in the upper leaves. The border of the vaginant lamina is quite characteristic. It is 4-5 cells wide, but ceases properly somewhat above the base, gradually merging in the long quadrangular or polygonal cells of the leaf base. The teeth are quite long and slender, rather deeply divided, resembling those of *F. minutulus*. They are very papillose, the trabeculae prominent, the parts spirally thickened above the middle. The capsule of *F. incurvus* is not always curved, it may be erect as in *F. synoicus*. I find it thus in a collection made at Savanna, Ill. The two collections of P. Reinsch cited above differ from each other in this respect. Both have the same kind of habitat, moist places in the forests of the Vosges. One collection has the typical curved or horizontal capsule, the other the erect. All three have the same structure of leaf cells, the latter $8-15\mu$ in diameter, the average 11 or 12μ .*

The other species to be considered are *F. exiguus* and *F. minutulus*. They were described and figured by Sullivant in 1846. (Mem. Am. Acad. N. Ser. 3: 58-60. T. 2, 1846. Also Icon. Mus. Part 1, 36, 37, T. 23, 24, 1864.) As such they were retained in Gray's Manual and so appear in that of Lesquereux and James. Austin made them varieties of *F. incurvus*. Barnes and Grout made the same disposition of them, but the latter with a reservation that the later maturing of the spores in August rather indicates a specific rank. By European bryologists one or both have been regarded as species or been considered the equivalent of other species or varieties. Thus both have been referred to *F. pusillus* Wils., and *F. exiguus* to *F. viridulus* Wahl. *F. minutulus* has been made *F. pusillus* var. *madius* Spruce, *F.*

*The name *F. synoicus* n. sp. appears a second time in bryological literature, having been used by C. Müller for a species collected in Argentina, South America, in 1873, and published in Linnaea, 42: 240, 1878, 1879. From the reading of the description I hardly take it to be the same as Sullivant's moss. If not a homonym of *F. synoicus* Sulliv. (1856), it is invalidated by priority, and the one from Argentina should be given another name if on comparison it is found to be distinct.

exiguus the same as *F. pusillus* var. *Lylei* Wils., or *F. viridulus* var. *Lylei* (Wils.) Dixon. This reference to at least three species and two varieties, along with specific rank besides, shows much diversity of opinion, and that it may be less confusing to leave them as Sullivant had them.

Both are quite similar in habitat, the most common the dry channels of brooks and rills as I have seen them. *F. minutulus* I have also collected on stones in damp places of woods or on ledges of rock by larger streams. The desiccated condition of the more common habitat favors their fruiting in mid-summer, since the stream beds are without running water, though it may remain in pools; the localities are therefore moist and commonly shaded. *F. minutulus* is apt to adhere very closely to a rock substratum. There may be no more appearance of a soil beneath it other than of the disintegrated rock than in some crustaceous lichens, or some species of *Orthotrichum* and *Grimmia*. There seems to be no choice of mineral constituents, for the stones and pebbles are of the various kinds washed from the drift in which the channels are cut. When on ledges they have been calcareous, which may be because the localities commonly accessible to me are of limestone formation. It is also apt to be unassociated with other mosses. *F. exiguus* I have found associated on clay with *Amblystegium varium*.

Both species are dioicous, the male flowers mostly on shorter plants, which are sometimes little more than buds provided with rhizoids and concealed in the rhizoids of the larger fertile or sterile stems. In this they differ from *F. incurvus*, of which they have been made a variety, and which is described by most authors as autoicous, though Roth makes it dioicous. Warnstorf gives it as both dioicous and autoicous. They may be deceptive in this respect. The male flowers on the short basal branches may be well furnished with rhizoids and easily detached by the slightest force. When this happens accidentally or spontaneously the male flowers will appear as little stems among the rhizoids of the fertile plants, as in the case of *F. minutulus*. When well advanced in growth there is apparently no vital connection with the parent plants even when remaining in place. From this experience with them I have been led to infer that the male organs may start as buds in the axils of leaves of fertile stems and become independent actually or apparently, or show a pseudo-dioicous inflorescence, which may account for some of the discrepancies.

The principal distinction between *F. minutulus* and *F. exiguus* has been found in the character of the leaf-margin. It is called immarginate in the latter; I have not found this quite exact. There are two types of border in Fissidens, one of linear cells that may be cord-like and not always firmly united to the cells of the body of the leaf. *F. bryoides* is one of the best examples. With it are classed *minutulus*, *incurvus* and *inconstans*. The other type has a row or band of cells less or but slightly chlorophyllose and consequently less deeply colored and more translucent than the remaining cells of the leaf, or they may be differently colored with some tinge as of yellow. They are also in general more uniform in size and shape. This kind of margin varies from a single row of cells to a band or zone four or five cells wide. The wide yellowish form is seen in *F. cristatus* and *F. adiantoides*;

while in *F. taxifolius* and *F. osmundoides* it is of less thickened cells and but one or two cells wide. *F. exiguus* can be placed in this class though not always so closely and uniformly defined. It has a marginal row of cells lighter and more pellucid as well as more nearly square or less irregular than the remaining leaf-cells. I had made a note of this when first finding the species several years ago, and have used it since as a help in distinguishing the two closely allied species. It is just as apparent in the example from the Musci Alleghanienses. In the drawing of the leaf *F. exiguus* in Sullivan's *Icones Muscorum*, Pl. 23, Fig. 9, this feature is not clearly brought out, and the margin does not differ essentially from the remaining cells of the leaf, only slightly more uniform perhaps. The squarish and more uniform size of the marginal row is more apparent in the plate accompanying the original description in the *Memoirs of the American Academy*, n. ser. iii, Tab. 11, B Fig. 2, though as Sullivan viewed it, it was with "foliis immarginatis," as compared with the "lamina limbata" of *F. minutulus* figured on the same plate. Leaves with a border row of pellucid cells of this character, whether called immarginate or marginate, are readily distinguished from those with the margin of *F. minutulus*. As remarked above on the leaf of *F. Bambergeri*, where the border with the linear type of cells was absent, there was an appearance of the other type.

Comparing the two in other respects the leaves of *F. exiguus* are more shortly and abruptly pointed, maintaining their width more fully to near the apex, making a shortly acuminate or acute leaf. Its capsule is commonly thicker in proportion to its length, the operculum with a shorter and stouter beak. In both the teeth are very papillose but in *minutulus* they are exceedingly long and slender, more so than in any considered in this paper, and so deeply cleft that one or both parts, though apt to be unequal, may be four times the length of the basal portion. In *exiguus* they are about twice the length, appearing less deeply divided though the basal part may be as broad as in *minutulus*. The trabeculae in *F. minutulus* are mainly horizontal but vary to oblique: or the projections may even take the spiral and somewhat thickened forms, the latter features quite exceptional as I have found them. In *F. exiguus* the spirally thickened form becomes more obvious, but as it is an inconstant character in both its value is not great in distinguishing them from each other, though on account of its quite uniform presence in *bryoides*, *inconstans* and *incurvus*, it is useful in separating the two from these.

In conclusion I wish to acknowledge my indebtedness to Mrs. Agnes Chase, of Washington, D. C., for the drawings and for copies of descriptions, and to Mrs. Elizabeth G. Britton and Prof. W. G. Farlow for the gift or loan of specimens.

Chicago, Ill.

February, 1907.

CATHARINEA CRISPA IN MAINE.

ALICE L. CROCKETT.

It is a pleasure to announce the discovery of a station for *Catharinea crispa* James, in Maine, it not having been reported before from this State, nor so far northeasterly as this. It was found in fruit in Camden, Maine, 44° N. lat, 69° W. long., in a pasture near the bank of a large brook, on knolls where six years ago a growth of alders had been cleared away. The altitude is about 200 feet. For its determination I am indebted to Mr. E. B. Chamberlain. Prof. J. Franklin Collins, in his list of New England plants, *Rhodora* 8: 131, 1906, gives only Massachusetts as definitely possessing it. See also *Rhodora* 9: 74, 1907.

Camden, Maine.